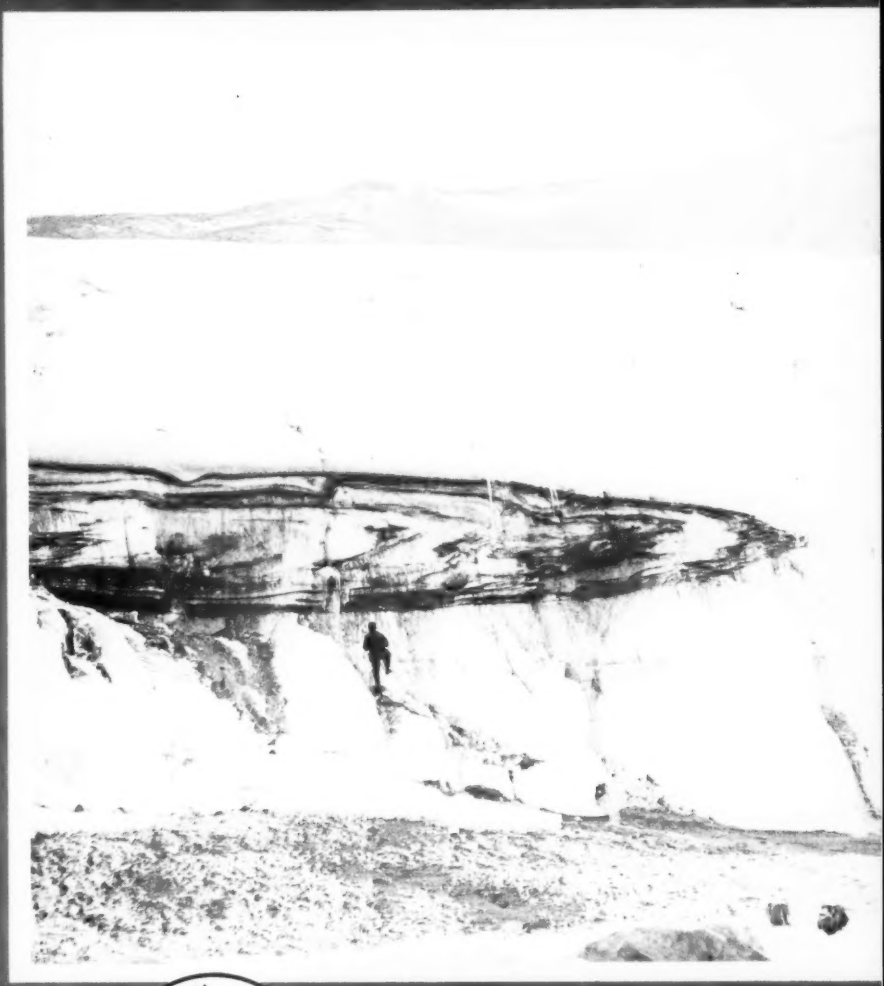
GeoTimes

Professional News Magazine



COORDINATION – COOPERATION
G A I
SERVICE

July-Aug. 1959

Vol. IV, No. 1

Published by the
American Geological Institute

Calendar

Cooperation of Society Secretaries in supplying meeting notices for GEOTIMES calendar is requested.

Aug. 25-28, 1959—TENTH ALASKAN SCIENCE CONF. (AAAS), Juneau, Alaska. Geology Section Chairman, Charles V. Fulmer, Box 7-839, Anchorage, Alaska.

Aug. 24-30, 1959—5th CONGRESS OF THE INTERNATIONAL COMMISSION OF OPTICS, Stockholm, Sweden.

Aug. 30 - Sept. 12, 1959 — INTERNATIONAL OCEANOGRAPHIC CONGRESS, AAAS, UNESCO & ICSU special committee on oceanic research cooperating; United Nations Bldg., N.Y. Write: Dr. Mary Sears, Woods Hole Oceanographic Institution, Woods Hole, Mass.

Oct. 4-7, 1959—AIME: Soc. Petr. Engrs., Fall Mtg., Dallas, Texas.

Oct. 8-10, 1959—AAPG: SW Fed. of Geol. Soc's., 2nd Ann. mtg., Lubbock, Texas.

October 8-10, 1959—OPTICAL SOC. OF AMERICA, Ann. Mtg., Chateau Laurier, Ottawa, Canada.

Oct. 22-23, 1959—AIME: Los Angeles Basin Sect., Fall Mtg., Huntington Sheraton Hotel, Pasadena, Calif.

Oct. 27-29, 1959—AIME: Joint Solid Fuels Conf., Netherlands Plaza Hotel, Cincinnati, Ohio.

*Oct. 27-31, 1959—AAPG: Mid-Continent-Kans. Geol. Soc. Mtg., Broadview Hotel, Wichita. Two one-day field trips of Pennsylvanian and Permian rocks of south-central Kansas; write: Merriam, Univ. of Kans., Lawrence.

Oct. 29-30, 1959—AIME: Oil Recovery Symposium on SW Texas, Corpus Christi, Tex.

*Oct. 31-Nov. 7, 1959—GSA: Ann. Mtg., with Pittsburgh Geol. Soc., Pittsburgh, Pa. Two 3-day trips of Valley and Ridge and Appalachian Plateau; two 1-day trips of SW Penn. and central Penn. Write: Buckwalter, Univ. of Pgh., Pittsburgh. Guidebooks.

Nov. 9-12, 1959—SEGp: Ann. Mtg., Biltmore Hotel, Los Angeles, Calif. Jointly with Pacific Section of AAPG on Nov. 12.

Nov. 12-13, 1959—AAPG: PACIFIC SECT., Biltmore Hotel, Los Angeles, Calif. Jointly with SEGp on Nov. 12.

Dec. 12-13, 1959—OKLAHOMA ACAD. OF SCIENCE, Earth Science Sect., Ann. Mtg., Weatherford, Okla.

July 25-Aug. 6, 1960—IUGG: General Assembly, Helsinki, Finland. Inquire: Sec. Gen. G. Laclavere, 30 Avenue Rapp, Paris 7, France.

*Aug. 6-12, 1960—19th INTERNATIONAL GEOGRAPHIC CONGRESS, General Assembly of the IGU and meetings of the IGU Commission, Stockholm, Sweden. Inquire: The International Geographic Congress Postfack Stockholm 6, Sweden.

*Aug. 15 - 25, 1960 — XXI INTERNATIONAL GEOLOGICAL CONGRESS, to be held at the Mineralogical Geological Museum of the University of Copenhagen in Denmark. Field trips before and after the meetings.

1959 SCHEDULE OF FIELD TRIPS

For additional field trips held in conjunction with meetings, see those items marked with an asterisk under meeting calendar.

Aug. 12-15—BILLINGS GEOL. SOC., field trip of Sweetwater arch & disturbed belt near Great Falls and Helena, Mont. Write: Busby, Box 1836, Billings. Guidebook.

Sept. 9-11—WYOMING GEOL. SOC., group field trips to Big Horn Basin, Wyo. Write: Leverett, Box 875, Thermopolis. Guidebook.

Sept. 10-12—ALBERTA SOC. OF PETR. GEOLOGISTS, 9th Field Conference. Technical session Sept. 10, trip to Moose Mountain Sept. 11, trip to Drumheller Sept. 12.

Sept. 10-12—IAPG: field trip and camp out in Wasatch-Uinta Mtns. area of Utah. Write: John Osmond, Box 34, Salt Lake City, Utah.

Sept. 12-13—FRIENDS OF THE PLEISTOCENE, Rocky Mtn. Sect., field trip to Wind River Mts., Pinedale, Wyo. Write: Richmond, Denver Federal Center.

Sept. 13—ILLINOIS STATE GEOL. SURV., field trip to Silurian of Whiteside and Carroll Co's., Ill.

Early Oct.—UTAH GEOL. SOC., field trip of strat, struct. & economics of S Qqirrh Range, Utah; write Rigby or Bissell at Brigham Young Univ., Provo, Utah. Guidebook.

Oct. 4—ILLINOIS STATE GEOL. SURV., field trip of Coal Measures of Clark and Edgar Co's.

Oct. 7-10—ROCKY MOUNTAIN ASSOC. GEOL., field trip of Cretaceous of western Colo., a Cretaceous symposium of Colo. Write: Kretz, 722 Patterson Bldg., Denver. Guidebook.

Mid-Oct.—TRI-STATE GEOL. FIELD CONF., field trip of Cambrian & Ordovician of Driftless area, SW Wisc.; write: Cline, Univ. Wisc., Madison, Wisc.

Oct. 15-17—NEW MEXICO GEOL. SOC., general geology of West Central New Mexico; write NMGS, Box 27, Socorro, N.M. Guidebook.

Oct. 17-18—NEW ENGLAND INTERCOLL. GEOL. CONF., field trip to cover Taconic sequence in W. Vt., Vt. marble belt, and Foreland sequence E of Lake Champlain; write: John B. Lucke, Univ. Conn., Dept. Geol., Storrs, Conn. Guidebook.

Oct. 18—ILLINOIS STATE GEOL. SURV., field trip of Coal Measures of Washington Co., Ill.

Nov. 5-8—WEST TEXAS GEOLOGICAL SOCIETY, field trip to Val Verde Basin of Terrell, Pecos, and Val Verde Counties, Texas. Write: E. L. Dillon, Box 1509, Midland, Texas. Guidebook.

XXI INTERNATIONAL GEOLOGICAL CONGRESS

Copenhagen, Denmark

August 15-25, 1960

Sponsors

Denmark, Finland, Iceland, Norway, Sweden

Prior to the Congress there will be 48 field excursions to various geologic areas in the Nordic countries and following the Congress 43 excursions.

The Second Circular may be obtained by writing:

CONGRESS TRAVEL
AMERICAN GEOLOGICAL INSTITUTE
2101 CONSTITUTION AVE., N.W.
WASHINGTON 25, D. C.

This Month in GEOTIMES

Professional News Magazine

Published by THE AMERICAN GEOLOGICAL INSTITUTE

Robert C. Stephenson, EDITOR

Kathryn Lohman, CIRCULATION MANAGER

Vol. IV, No. 1 July-Aug. 1959

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Depth in Thinking

A. I. Levorsen recently said, "Depth in geological thinking is of equal importance to depth in drilling," if we are to meet the petroleum exploration needs of the coming years.

It would appear that many geologists show more interest in new developments in drilling methods and equipment than they do in the new tools of their own profession. Just as a new type draw works can add significantly to the speed of drilling or the depth range, new ideas and knowledge can add significantly to a geologist's depth of thinking.

A round trip for a new drill bit is appreciated by all as necessary to the drilling of a hole. However, round trips through the geological literature to sharpen mental tools for the improvement of the geologist's depth in thinking are often ignored.

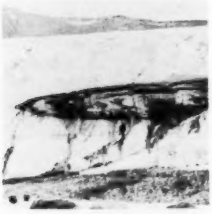
Experience on the part of the toolpusher is vital in getting the most out of his equipment, but the performance of the most experienced toolpusher in the world is limited by the size and condition of the rig. So it is with the geologist. Experience is invaluable, but to penetrate to the maximum depth with his geological thinking, the geologist must be soundly and wisely equipped.

The contract to drill a deep hole doesn't go to the fellow with a lot of "hardly able" equipment. It goes to the contractor with a capable, well-organized setup. If a company needs depth in geological thinking it must turn to the geologist who gives attention to his professional tools. The company must seek the geologists who have good academic backgrounds and who continue to be students of geology throughout their careers if they are to achieve maximum depth in their geological efforts.

When supplies are up and prices of crude oil go down, drilling tools go on the rack to deteriorate through lack of use. At the same time substantial numbers of the geological profession also are put on the rack by industry only to grow rusty or become dissipated through lack of use.

There is one significant point of difference: The geologist who has been put on the rack to rust may climb down and go elsewhere, discouraged by the whims of the business. If the demand rises sharply, however, and industry feels the need to stock up on geologists capable of the deepest geological thinking, it is likely to find delivery of the new replacements to be very slow—it takes 7-8 years to produce a deluxe Ph.D.-type geologist. Delays may be further accentuated by lack of raw materials, for the most able minds may be going into more rewarding fields.

A good geologist must be well-equipped, he must keep his mental tools sharp, but he must be kept at work if the maximum depth in geologic thinking is to be realized.



OUR COVER

View of side of the lower Taylor Glacier in South Victoria Land Antarctica. *Photo by Warren Hamilton & Philip T. Hayes, U. S. Geological Survey.* *(See page 16)*

The AMERICAN GEOLOGICAL INSTITUTE is a non-profit professional service organization established and managed by the scientific societies in the fields of geology and geophysics in cooperation with the National Academy of Sciences-National Research Council. It is the instrument of the profession serving and advancing the welfare of the geoscientist in matters relating to education, professional responsibilities and government relations. It is an active member of the Scientific Manpower Commission. It also functions in the stimulation of public education and awareness of the earth sciences, through career literature, the scouting program and other channels of communication.

GEOTIMES is the news magazine of the geological sciences. It reports on current events in the earth sciences, public education and public relations efforts throughout the profession, as well as appropriate legislative and governmental issues. It announces scholarships, fellowships, publications and new developments. It provides a forum for discussion of timely professional problems, and affords a common bond between the many specialized groups within the earth sciences

GEOLOGY AND GEOLOGISTS OF JAPAN

By KEIICHI OMORI

Japan consists mainly of four islands: Hokkaido, Honshu, Shikoku and Kyushu. In the middle of Honshu is a zone called "Fossa Magna," which divides the islands geologically, as shown in the figure, into two parts: northern and southern Japan. The former is mainly covered by Cenozoic and pre-Tertiary formations, while the latter consists principally of Mesozoic and Paleozoic formations.

In northeastern Honshu, there are two isolated mountainlands, Kitakami, to the north of Sendai, and Abukuma, to the south. The structural trend of Kitakami is NNW-SSE and of Abkumua nearly N-S. Tertiary formations are widely distributed along the western side and a Quaternary volcanic zone runs in a generally north-south direction down the middle.

In southwestern Japan is a tectonic belt called the median line. Rocks to south of the line are crystalline schists and phyllites accompanied by some basic intrusives and Paleozoic and Mesozoic formations. Immediately north of the median line, rocks are biotite schist, biotite gneiss and related granitic rocks, but a major portion of the area north of the line is composed of Paleozoic rocks extensively intruded by granite. Volcanoes have erupted violently in central and southern Kyushu from Pliocene to Recent.

The western peninsula of Hokkaido is geologically similar to the Cenozoic area of northeastern Honshu. Central Hokkaido consists of Cretaceous and pre-Cretaceous formations. The folded mountain axis terrain consists of Paleozoic formations and regionally metamorphosed rocks. In eastern Hokkaido, a Neogene volcanic formation covers Cretaceous and Paleozoic formations. In the middle of this area are many volcanoes belonging to the same volcanic zone as the Kurile islands.

Japan has rich variety of mineral deposits, however, most are small. Tertiary coal is mined in central Hokkaido and northern Kyushu. The Paleogene deposits in northern Kyushu contain Japan's most important coal measures. They have about 6 billion tons, or about 37 percent of Japan's total coal reserves. Petroleum is found in Neogene formations in a folded zone along the Japanese Sea.

Many epithermal vein deposits or replacement bodies containing ores of gold, silver, copper, lead, zinc, mercury, iron, sulfur and others are distributed in the Tertiary or Quaternary volcanic regions. Some of the metallic deposits are related to granitic intrusives, particularly of late Mesozoic age, which are fissure-filling replacement or contact metamorphic types. Copper-bearing pyrite deposits are embedded in crystalline schists or phyllites. Southwestern Japan also has economically important resources.

GEOLOGISTS, INSTITUTIONS, AND PROJECTS

Japan has over 400 colleges and universities, of these about 20 have departments of geology or related sciences. Each year, from 300 to 400 geologists are graduated, with a specialty distribution approximately as follows: general geology, geochemistry and petrography, 40 percent; economic and mining geology, 40 percent; mineralogy and crystallography, 12 percent; paleontologists and others, 8 percent.

The principal departments of geology in Japan are at the following universities:

• Tokyo University, Tokyo, Shares Depart-

ment with Hiroshima Educational University.

- Tohoku University, Sendai
- Kyoto University, Kyoto
- Hokkaido University, Sapporo
- Kyushu University, Fukuoka

Recent activities in the field of mineralogy at these universities, or by members of their departments of geology, are briefly as follows:

Tokyo University

The crystallography of minerals of Japan, analyzed principally by X-ray methods, is being studied and many papers have been published on the results. A celebration in honor of Professor Teiichi Ito's sixtieth birthday was held last autumn by his co-workers and former students. Professors Ito and N. Katayama attended meetings for the founding of the International Mineralogical Association held in Madrid, Spain, April 1958. Dr. N. Morimoto is on leave to study phase relations at the Geophysical Laboratory, U. S. Geological Survey, Washington, D. C.

Tohoku University

The science of geology is covered at Tohoku by 1. The Institute of Mineralogy, Petrology, and Economic Geology, and 2. The Institute of Geology and Paleontology. Current research in the mineralogy institute includes detailed studies on pegmatite minerals, with particular emphasis on minerals of uranium, thorium, niobium, tantalum, and the rare-earth elements. Professor Keiichi Omori has surveyed more than 2,000 pegmatites of Japan, northern Korea, and southern Inner Mongolia. He has, since September 1958, been investigating infrared spectra of minerals at Columbia University, New York, with Professor Paul F. Kerr.

Kyoto University

Assistant Professor Yasuo Ukai and coworkers are studying radioactive minerals. Dr. T. Ueda is at the University of Illinois studying rock-forming minerals.

Hokkaido University

A special collection of mineralogical papers by friends and former students of Professor Zumpei Harada was published as part of the celebration of his sixtieth birthday.

Kyushu University

Professor Toyofumi Yoshimura is investigating manganese minerals of Japan and Professor Toshio Sudo is studying clay minerals at Tokyo Educational University.

There are two principal mineralogical societies in Japan. One is the Japanese Association of Mineralogists, Petrologists and Economic Geologists, established in 1929. It has published 42 volumes (the last with 6 numbers) of a journal carrying the association name. The address of the association is care of Tohoku University, Sendai, Japan. The other is the Mineralogical Society of Japan, which was established several years ago. Its address is care of Tokyo University, Tokyo, Japan. It has two periodicals, the Journal of the Mineralogical Society of Japan, of which 3 volumes have appeared, and Mineralogical Journal, written in English, of which 2 volumes have been published. These two societies publish about 80 mineralogical papers each year.

There are many other professors, geologists and students in Japan actively engaged in field studies and laboratory research. Professor S. Hanzawa of Tohoku University is well known for his studies of fusuline Foraminifera. He is now lecturing on paleontology at New York University. A special publication on geology and paleontology has been prepared in celebration of Professor Hanzawa's sixtieth birthday and is to be distributed after his return to Japan this coming winter. Professors T. Kobayashi and F. Takai of Tokyo University are specialists in Mesozoic geology and Cenozoic paleontology respectively. Professor H. Kuno is recuperating from a serious illness and plans to continue his interesting investigations of basaltic magma in the near future. Professor Y. Kawano of Tohoku University who left the Geological Survey last year is running chemical analyses of the volcanic rocks of northeastern Japan. An outstanding contribution being made by the Geological Survey of Japan is its series of 1/50,000 geological maps of Japan.

Professor Keiichi Omori has been on leave during the past year from Tohoku University, Sendai, Japan. He has been studying with Professor Kerr at Columbia University as a Quincy Ward Boese Postdoctoral Fellow in Geology.

MEASURING DIPPING BEDS

Ancient but little used Jacob staff method often ideal

By G. D. Robinson [2]

For some years, my work has involved the repeated detailed measurement in mountain country of a very thick section of strata with dips of 20° to 50°. Innocent both of training and thought in stratigraphic measurement, I first plunged into the task with plane table and telescopic alidade, with assists from the steel tape. After a few hundred observations and several times that many tiresome calculations, I began seeking an easier way to handle the problem within the limits of error inherent in measuring deformed and incompletely exposed rocks. Eventually, I devised a simple method for measuring thickness directly with an Abney level mounted on a 5-foot wooden dowel.

The thrill of discovery was short-lived: I soon became aware of a respectable literature on direct thickness measurements. Nearly 80 years earlier, Walcott (1888) had published a description of a comparable device, consisting of a rod and a clinometer compass. Almost 50 years earlier, Hayes (1909) had described three variants on direct measurement: Walcott's method, mine, and another employing the Brunton compass. Four years later, Blackwelder (1913) had independently discovered the Brunton variant. In 1943 Kummel had described an even simpler rod-and-clinometer combination than that of Walcott and Hayes, and called it a Jacob staff. Inspired by Kummel's paper, Bröggi (1946) systematically examined the principles involved in direct thickness measurement with the Jacob staff and their application to different field situations.

Recently, the Jacob staff method has been described in Low's handbook (1957) and some refinements of Kummel's device have been suggested (Ingbrigsten, 1957; Bergstrom, 1958).

This might be thought enough attention to so simple a matter. Yet discussions with many colleagues and a review of American stratigraphic literature of the last decade suggest that most geologists working in deformed rocks have not discovered Jacobstaffing, but are plodding through time- and energy-consuming procedures with alidade or tape, or with some other method that requires trigonometric calculations, with no advantage in accuracy though sometimes with greater precision. The purposes of this paper are to call further attention to Jacobstaffing, to note some of its virtues and limitations, and to give information on making a kind of Jacob staff that uses the Abney level.

The manuscript has benefitted from critical review by Lawrence C. Craig, Wallace R. Hansen, William H. Hays, and Harry Tourtelot. John R. Stacy prepared the illustration.

[1] Publication authorized by the Director, U.S. Geological Survey.

[2] G. D. Robinson, U.S. Geological Survey, Denver Federal Survey, Denver, Colorado.

History and Etymology

"It would be ridiculous, to go about to praise an art that all mankind know they cannot live peaceably without, and is near hand as ancient (no doubt on it) as the world . . ." J. Love, Geodaesia, 1688.

The papers cited earlier tell much about the Jacob staff in stratigraphic work, but little about the background of the tool or its name. To fill this small void, source materials in libraries near Denver were briefly examined. The historical notes below, while hardly exhaustive, may nevertheless satisfy the curiosity of most readers.

The name Jacob staff clearly derives from Jacob's prayer in Genesis 32-10 (Revised Standard Version): "I am not worthy of the least of all the steadfast love and all the faithfulness which thou has shown to thy servant, for with only my staff I crossed this Jordan; and now I have become two companies."

The use of a stick to steady a surveying device very likely goes almost as far back as the first Jacob—the dioptra described by

Vitruvius in the 1st Century B.C. (Hoover and Hoover, 1950, footnote p. 129) is a well-known early example, and the "merkhet" of ancient Egypt (Burnside, 1958, p. 61) a still earlier. But the earliest recorded application of the name Jacob's staff to such a device was a mere 400 years ago. In 1559, according to Murray (1901, p. 542), Jacob's staff appeared in Cunningham's Cosmographer's Glass as the name of a simple instrument employed by astronomers and navigators for observing the altitude of the sun (called also astronomer's staff and, by others, cross-staff). This early technical meaning evidently evolved from popular use of the term for a pilgrim's staff, as in Hall's Chronicles of Henry VIII, dated 1548. Later, the name was for a time given, somewhat more glamorously, to a staff containing a concealed sword or dagger.

Just when Jacob's staff came to mean a rod on which to mount a simple land surveying instrument—generally a "circumferentor" (primitive transit) or a compass—is uncertain, but it most likely was late in the 17th Century or early in the 18th. The usage does not appear in popular early 17th Century works on surveying, such as Leybourn's or even in the eleventh edition (1792) of Love's popular work on the surveyor's art, first printed in 1688; nevertheless it was well established in Colonial America, a Jacob's staff, by that name, being standard equipment for such surveyors as George Washington (Freeman, 1948, p. 197).

Firmly fixed in the cant vocabulary of American surveyors and other engineers in the 18th Century, the name does not seem to have been taken up by geologists until late in the 19th Century. The first geologists to use the term Jacob's staff, and perhaps the tool as well, seem to have been the early investigators of the iron resources of the Lake Superior region. Searching for buried magnetic ore, they were the first geologists to make large numbers of systematic compass observations, and thus to feel the need for a better compass support than the human hand. The great Lake Superior pioneer, T. B. Brooks, felt no such need (1873, p. 211-212) but at century's end Smyth stated (in Clements and Smyth, 1899, p. 342) "At work, this instrument [the dial- or sun-compass] is mounted on a light Jacob's staff, or it may be held in the hand. The Jacob's staff, though often inconvenient to carry, is preferable . . ." Like the engineers, the iron hunters held the staff in vertical position, as a support for a device that made its

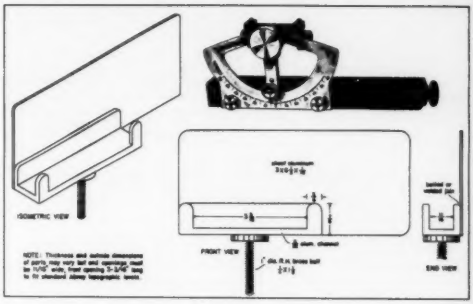


Figure 1.—Abney topographic level and bracket for attaching it to wooden staff.

measurements at right angles to the staff. To them, the Jacob's staff was merely a support.

Field use of the name for a stratigraphic tool doubtless goes far back in this century, but I have not found it in print prior to Kummel's paper of 1943. Kummel himself made clear that his usage is not original. As adapted by Kummel, the term is broadened to include the attached clinometer as well as the supporting rod. This reasonably reflects the fact that the rod is no longer merely a support, but has become an integral part of the instrument. Kummel also dropped the possessive ending. Thus in one stroke he commited synecdoche and literary larceny, but achieved clarity and economy. Kummel's extended meaning and contracted spelling have been widely accepted.

Not all users of the instrument care for its antique name. Some of my colleagues deplorably refer to it as a pogo stick or even as a glorified mop handle.

The Jacob Staff

How to measure directly the thickness of inclined strata was neatly described by Hayes in the first edition of his Handbook (1909, pp. 29 and 30):

"To the upper end of a rod of convenient length—5 feet is about right for a man of ordinary height—is fastened a short arm to form a right-angled T.[3] A zigzag jointed 5-foot rule may be used instead of the rod. In addition to the rod either (a) a hinged clinometer with level on one arm, or (b) an Abney level, or (c) a Brunton compass is used. The dip of the beds is determined, and if a clinometer is used the arms are opened so that the angle between them is equal to the dip angle. If then, the lower limb of the clinometer is held firmly on

[3] With any luck at all, this desciription would have led to the happy name "Hayes-T" for both instrument and method, and a distinctively geologic tool would have a distinctively geologic name.

(Continued on page 24)

GEOLOGY in an Academic Year Institute

by

ROBERT E. STEVENSON

Geology was an integral part of the 1958-59 National Science Foundation sponsored Academic Year Institute at the State University of South Dakota. The prime objective of the Institute was to increase the knowledge of subject matter in science and mathematics for secondary school teachers.

Three of the 50 participants in this Institute were majors in geology, working either toward the Master of Arts degree (20 hours of geology, 8 hours of a science minor) with thesis, or the Master in Natural Science degree without thesis. The M. in Nat. Sc. requires the completion of a research problem in the 20 hour major and a single or combined science minor of 15 to 17 hours. Some participants come without adequate undergraduate backgrounds in geology. Such students were required to take basic undergraduate courses for 20 hours before entering a graduate program. All participants receive a certificate of completion at the close of the Institute.

The Institute participants majoring in geology took the same courses as the regular graduate students and did very well. A number of participants minored in geology by taking 8 hours of *"Geology for Science Teachers."* This course consisted of a complete set of lectures and laboratories in general geology and a series of discussions on the teaching of geology in the secondary schools. During the discussion sessions an earth science syllabus is prepared for a junior high general science course.

All participants were required to attend weekly general seminar meetings, at which time they heard a series of lectures in the various scientific fields. Some speakers were University faculty other than the Institute staff, who lectured on such topics as History of Science; Career Opportunities in Engineering, Medicine, Medical Technology, and Nursing; Radiological Aspects of Civil Defense and others. Each department of the Institute, botany, chemistry, geology, mathematics, physics, and zoology, selected two Visiting Scientists for the weekly seminar. These Visiting Scientists also spoke at a supplementary seminar for the major and minor students in the scientist's field, as well as participating in discussions with under-graduates, graduates, and staff of the department that invited them. Professor W. C. Krumbein, the AGI Visiting Geoscientist for the University of South Dakota, also spoke to the Institute participants.

Earth science is briefly presented to the secondary school as a part of the general science course usually taught by a science or mathematics teacher who knows little or nothing of geology. Such teachers without some training in geology will not present the science properly and it will, therefore, be meaningless to most students. I feel that the Institute participants who majored or minored in geology can now present the science of geology accurately and interestingly to the high school student. This I believe is the Geology Department's accomplishment in the N.S.F. Academic Year Institute 1958-59 at the State University of South Dakota.

[1] Robert E. Stevenson Professor & Chairman of Geology, State University of South Dakota, Vermillion, S. D.

Symposium on Arctic Geology

January 11-13, 1960
Calgary, Alberta

The First International Symposium on the Geology of the Arctic will be held in Calgary, Alberta, Canada, under auspices of the Alberta Geological Society of Petroleum Geologists.

Principal subjects to be discussed will be:

1. Stratigraphy, Biostratigraphy and Tectonics of the circum-Arctic Territories and of the Arctic Ocean "Basin."
2. Economic Geology, Oceanography, Glaciology and Permafrost.

Other objectives of the conference will be to seek to strengthen international contacts and possibly cooperative efforts of groups working on Arctic problems. Consideration will be given to the publication of a periodical devoted to Arctic geology. International support of the 1960 Symposium appears assured at this date.

George S. Hume is honorary chairman of the Symposium and Theodore A. Link is general chairman. Interested persons should write D. W. R. WILSON, *General Secretary, Arctic Symposium Committee, P.O. Box 100, Calgary, Alberta.*

COMMITTEE OF 1000 FOR AGI REACHES 388 MEMBERS

In the fall of 1959 Bob Karpinski, professor of geology at the University of Illinois, Navy Pier, on his own initiative started a program to aid in the financing of AGI. He conceived the Committee of 1000 for AGI and personally handed to the AGI Board of Directors $180 in funds collected from fellow geologists who wanted to show their support of the Institute through membership in the Committee of 1000 for AGI–1959. The funds were accepted by the AGI Board and the Committee of 1000 became official.

Karpinski, now on leave for study and travel in Europe, visualized the Committee of 1000 for AGI as a local action plan to augment the limited funds available from the profession through the contributions of AGI Member Societies. He suggested that local societies initiate group efforts on behalf of the Committee of 1000 to stimulate wider support. Although this aspect of his concept has not taken hold, the Committee of 1000 for AGI–1959 has been quite successful as a means of providing much-needed funds to the Institute for support of its program and GeoTimes.

Listed below are 116 additional names of persons who have joined the Committee of 1000 for AGI–1959 since the May-June issue of GeoTimes went to press. This brings the total membership to 388. Among the names published below and in previous issues of GeoTimes are those of many well-known members of the profession. The Committee of 1000 includes students, retirees, and many persons at various stages of their careers between these two extremes –all of whom care enough about AGI and the diverse services it is trying to render to provide tangible evidence of their support.

Members of the Committee of 1000 for AGI–1959 have made a contribution of $10 or more to the fund. Others who want to join the Committee of 1000 may do so by sending their contribution to the AMERICAN GEOLOGICAL INSTITUTE, *2101 Constitution Avenue, N.W., Washington 25, D. C.*

Recent Additions to the Committee of 1000 for AGI-1959*

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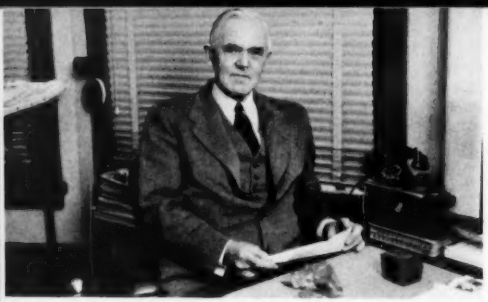
Carle H. Dane
Thos. W. Dibblee, Jr.
Philip Donnerstag
Eldridge Dwight Drew
Lee J. Eicher
Electrofrac Corporation
John H. Eric
Ralph E. Esarey
James R. Fasbender
Barney Feagin, Jr.
John H. Feth
Spencer F. Fine
John E. Frost
Robert F. Gantnier
Peter H. Gardett
George O. Gates
W. B. Gealy
Kenneth H. Gibson
Chas. L. Gilmore
Waldo S. Glock
Frank W. Godsey
C. S. Gwynne
John C. Haff
Dollie Radler Hall
Harvard Geology Club
Winthrop P. Haynes
Allan W. Hazard
Thos. A. Hendricks
William B. Heroy, Jr.
Richard V. Hollingsworth
Marlene E. Hyde
Earl Ingerson
John Winan Irving
Joseph S. Irwin
Richard H. Jahns
S. E. Jerome
Charles G. Johnson
W. P. Johnston
H. Allen Kelley
William S. W. Kew
Konrad B. Krauskopf
Harry S. Ladd
Paul W. Long
Wm. K. MacFarquhar
David B. MacLachlan
Roger S. Mahoney
L. E. Mannion
Marco P. Marchetti
John C. Maxwell
Neal E. McClymonds
W. D. McIntosh
Carl N. Metcalf
William B. Millar
Maynard M. Miller
L. & P. Moyd
Andrew J. Mozola
F. H. Muire
Ernest G. Mulle
Donal R. Mullineaux
Thomas B. Nolan
Dept. of Geology, Notre Dame Univ.
Louis C. Pakiser, Jr.
John M. Parker
Raymond A. Peterson
Richard Phillips
R. K. Robbins
Forbes Robertson
R. Burton Rose
Sam Rosenblum
Howard E. Rothrock
George M. Schwartz
E. J. Schwing
Harold W. Scott
Chester W. Shaw
F. P. Shepard
Paul Siemon
V. Zay Smith
Arthur H. Sorensen
Everett R. Stanley
Robert E. Stevenson
Robert Stone
Donald B. Tatlock
Spence T. Taylor
Edward L. Tullis
Grant T. Wickwire
Pat Wilde
Clark L. Wilson
Sheldon P. Wimpfen
C. E. Winn
C. W. Wolfe
Brame Womack
David H. Wozab
Herbert Yoho

* *For previous lists of members of the Committee of 1000 for AGI–1959, see GeoTimes Jan.-Feb., p. 22; March, p. 17, April, p. 17, and May-June, page 11.*



Mr. Lake Superior

At a recent meeting of the Lake Superior Geology Club, Hugh M. Roberts, consulting geologist and dean of the local mining profession was presented with a scroll naming him Lake Superior Geologist. The scroll illustrated with four items characteristic of the geological profession—a geologist's pick, a campfire replete with boiling teapot, a claim post and a super dip, was awarded Mr. Roberts in recognition of his worthy contributions to the study of iron ores in the Lake Superior region.

The award was made at the annual dinner meeting of the club held in Duluth early in April. At this meeting Mr. Roberts was not only the honored guest but also the principal speaker of the evening. His talk entitled "The Beginning of Things" described many interesting experiences of his career and pointed up the role that the geologist must play in mineral development.

Mr. Roberts, in his long career as an economic geologist, has worked from Hudson Bay in the north to Brazil in the south, and in many other far away places with strange sounding names. He was instrumental in the discovery of the Falconbridge nickel deposit at Sudbury, Ontario and the Steep Rock iron mine at Atikokan, Ontario. Mr. Roberts has maintained a consulting office in Duluth since 1926.

NSF RESEARCH GRANTS

Sept. 15 is deadline for proposals

The Earth Sciences Program of the National Science Foundation is now receiving proposals for research grants that will be made in February and March 1960. Deadline for the receipt of proposals for work to begin in the spring or early summer is September 15, 1959. There are no formal application blanks, but a Foundation pamphlet describes the method of making application and outlines the information needed in a proposal. This pamphlet may be obtained by writing directly to the *National Science Foundation, Washington 25, D. C., Attention: Earth Sciences Program.*

Geologists to Meet Offshore

Atlantic City April 1960

The petroleum geologists will converge on the famous Steel Pier in Atlantic City April 25-28, 1960, for the first national offshore meeting of geologists. The Steel Pier auditorium, from which the Miss America Pageant is televised each year, will be given over during the 45th annual meeting of the AAPG to the study of contours of a less eye-catching (but none-the-less intriguing) type.

The Geological Society of Washington will be hosts to the AAPG-SEPM members in Atlantic City. The local committee is planning interesting pre-meeting field trips which will give the visitors a good cross-section of classic Appalachian geology.

Following the Atlantic City meetings there will be an open house of Washington research laboratories, including the U. S. Geological Survey photogrammetric and topographic map making facilities, and the Beach Erosion Control Board. The climax of the Washington extension trip will be a special performance of the Pick and Hammer Show which will lampoon the big wigs among the oil finders.

The technical program for the Atlantic City meeting will be arranged around several planned symposia as follows:

- *Geometry of Sandstone Bodies,* sponsored by the AAPG Research Committee with J. A. Peterson as chairman.
- *Sedimentary and Tectonic Framework of the Atlantic Coastal Region,* with J. R. Balsley and J. T. Hack as co-chairmen.
- *Frontier Regions in World Exploration,* organized by Hollis D. Hedberg.
- *The Paleontological and Mineralogical Evidence for Polar Wandering & Continental Drift,* sponsored by the SEPM Research Committee and organized by A. C. Munyan.

Contributed papers are welcomed, but are subject to review as to suitability before being accepted for the Atlantic City meeting. Tentative titles should be filed before October 1, 1959. The deadline for abstracts is November 15, 1959.

Persons desiring to submit a paper should contact *AAPG Program Chairman,* FRANCIS J. PETTIJOHN, *Department of Geology, The Johns Hopkins University, Baltimore 18, Md.,* or *SEPM Program Chairman,* W. J. PLUMLEY, *California Research Corp., La Habre, Calif.*

XXI INTERNATIONAL GEOLOGICAL CONGRESS

Copenhagen, Aug. 15-25, 1960

Second Circular Distributed

The Second Circular for the XXI International Geological Congress, Copenhagen, Denmark, August 15-25, 1960, has been distributed by the Organizing Committee to all persons who filed form 1 which accompanied the First Circular.

Persons who have not made final application for the Congress and the pre- and post-Congress field excursions of their choice should do so at once for the field excursions are rapidly reaching maximum registration.

The response to the First Circular was very good. Over 2,000 prospective members returned the tentative application form, and these forms indicated that approximately 1,000 additional persons would be accompanying the Congress members. Many geologists of the United States and Canada are expecting to take their families to Europe in the summer of 1960 and combine attendance at the Congress with a tour of European countries.

Final registration forms for the Congress and the field excursions accompany the Second Circular. These must be completed and returned with a payment of the membership fee and a deposit for excursions. The membership fee is $24 U.S. for attending members and $10 each for all accompanying persons (this includes wives and children). A $40 deposit must be made for each field excursion for which one wants to register. Closing date for field excursion applications is September 1, 1959.

September 1 is also the closing date for all papers submitted for presentation at the Copenhagen Congress. Details concerning manuscripts and preparation of slides are given in the first and second circulars.

Sections of the Congress

The following subjects have been selected for discussion, each subject corresponding to a section of the Congress:

1. Geochemical cycles
2. Geological results of applied geochemistry and geophysics
3. Pre-Quarternary absolute age determination
4. Chronology and climatology of the Quaternary
5. The Cretaceous-Tertiary boundary
6. Pre-Quarternary micropaleontology
7. Ordovician and Silurian stratigraphy and correlations
8. Late pre-Cambrian and Cambrian stratigraphy
9. Pre-Cambrian stratigraphy and correlations
10. Submarine geology
11. Regional and structural problems in oil geology
12. Regional paleogeography
13. Petrographic provinces, igneous and metamorphic rocks
14. The Granite-Gneiss problem
15. Genetic problems of Uranium and Thorium deposits
16. Genetic problem of ores
17. Minerals and genesis of Pegmatites
18. Structure of the earth's crust and deformation of rocks
19. Caledonian orogeny
20. Applied geology
21. Other subjects

Holding meetings simultaneous with the International Geological Congress will be the following:

- International Paleontological Union
- Association of Sedimentary Petrologists
- International Association of Hydrogeologists
- International Mineralogical Association
- Sub-Commission on Stratigraphic Terminology of the International Commission on Stratigraphy
- International Commission for the Study of Clays

The second circular may be obtained upon request by addressing Congress Travel, American Geological Institute, *2101 Constitution Ave., N.W., Washington 25, D. C.*

EIGHTH NATIONAL CLAY CONFERENCE

Oct. 12-14, 1959
Norman, Okla.

The University of Oklahoma will be the host to the Eighth National Clay Conference to be held under auspices of the Clay Minerals Committee of the NAS-NRC in Norman, Oklahoma, Oct. 12-14. The meeting will feature symposia on *Clay-Water Systems* and *Clay Mineral-Geochemical Prospecting Methods* in addition to general sessions of contributed papers.

Further information may be obtained by writing Prof C. G. Dodd, *Chairman, Eighth National Clay Conference, U. of Oklahoma, Norman, Okla.*

GeoScience Abstracts

The opening number of the 1959 Menlo Park (Calif.) Pick and Hammer Show lampooned, or harpooned, *GeoScience Abstracts* with the following verse to the classic *"Wonderments:"*

The GeoScience Abstracts are but fifteen bucks a year—I wonder why, I wonder why—
If twenty Comrades shared the cost, it wouldn't seem too dear—
I wonder why, I wonder why—
The trouble is that everyone who buys 'em has to swear,
Upon a stack of Bibles, that he'll never dare to share
Their contents with a Commie, which is surely most unfair—I wonder why, I wonder why.

The Menlo Park geologists and others have been quite vocal in their criticism of the AGI policy which requires that individuals who wish to enjoy the benefits of the special $15 supscription price as a member of a supporting AGI Member Society must sign a pledge agreeing to restrict the journal to their own personal use. Such a pledge card system has been used most satisfactorily by one of the best known of the scientific abstract journals—but the dissenting geologists feel that such a requirement violates the Bill of Rights and should not be imposed on anybody, especially geologists and particularly them.

In starting *GeoScience Abstracts*, which replaced Geological Abstracts, discontinued by the GSA in December 1958, the Institute recognized that realistic subscription prices had to be established if the new abstract journal was to become self-sufficient. After considerable study the following scale of subscription prices was adopted:

A. To members of AGI Member Societies on GeoTimes mailing list (for personal use only —pledge card required) $15.00
B. Non-member individuals; colleges and universities; public libraries $35.00
C. Private organizations and government agencies $65.00

These rates reflect the potential number of users of each subscription and the differences between various types of subscribers. A predetermined estimate of subscription income needed to provide operating capital for *GeoScience Abstracts* served as the basis for establishing the rates.

If the pledge card system were discarded, as some geologists have proposed, the journal would be forced to go on a single subscription rate. There would be no $15 rate for individuals, no $35 rate for schools and libraries, and no $65 rate for other organizations. There would be a single rate of about $22.50 per year and we would have to have about 2,700 subscribers to meet gathering and production expenses. A 50 per cent increase in subscription rates to individuals would be a pretty steep increase—even for the rugged individualists who so resent the pledge cards. Despite the criticisms, no change in the rate structure for *GeoScience Abstracts* is contemplated.

GeoScience Abstracts has presented more than 1000 abstracts in the first four issues and there is growing evidence of wide acceptance of the new journal. It will offer in its first year more than three times the number of abstracts published formerly in Geological Abstracts.

GeoScience Abstracts

GeoScience Abstracts was started in January 1959 with very little advance publicity. The circulation has climbed steadily and is now about 1100. Individuals account for about 60 per cent of all subscribers. About half of the subscriptions are for 3 years at the special introductory rates of 3 years for the price of 2.

A sample copy of GeoScience Abstracts may be obtained by sending $0.50 to cover postage and handling to **American Geological Institute, 2101 Constitution Aveue, N.W., Washington 25, D. C.**

Opportunities in Cartography

The United States Civil Service Commission has announced an examination for Cartographer, Grades GS-5 through GS-15, with entering salaries of $4,040 to $12,770. A written test is required for applicants for positions at Grades GS-5 through GS-12. Accepted applicants will be eligible for consideration for employment by the Army Map Service, U. S. Geological Survey, and other Federal Agencies.

Interested persons should consult U. S. Civil Service Commission, Announcement No. 196 B, available through post offices, regional offices of the Commission or by writing the *Executive Secretary, Board of U. S. Civil Service Examiners, Army Map Service, Washington 25, D. C.*

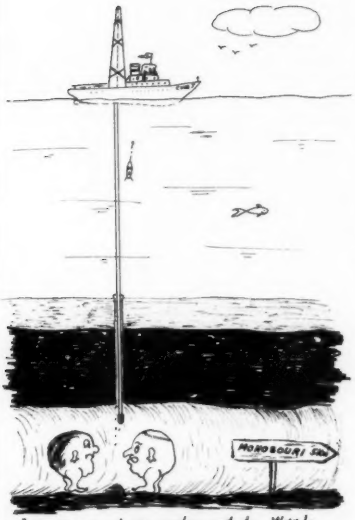
[1] In April 1960 the Pick and Hammer Show in Washington at the close of the AAPG-SEPM meeting at Atlantic City will pick on the "Mr. Bigs" among the petroleum geologists. Plan to attend if you want to have some real fun—at the expense of the leaders in petroleum geology.

CORRECTION FOR DIP IN DIRECTIONS NOT PERPENDICULAR TO STRIKE*

Angle of full dip	Angle between strike and direction of section							
	80°	75°	70°	65°	60°	55°	50°	45°
10°	9° 51'	9° 40'	9° 24'	9° 5'	8° 41'	8° 13'	7° 41'	7° 6'
15°	14° 47'	14° 31'	14° 8'	13° 39'	13° 34'	12° 28'	11° 36'	10° 4'
20°	19° 43'	19° 23'	18° 53'	18° 15'	17° 30'	16° 36'	15° 35'	14° 25'
25°	24° 48'	24° 15'	23° 39'	22° 55'	22° 0'	20° 54'	19° 39'	18° 15'
30°	29° 37'	29° 9'	28° 29'	27° 37'	26° 34'	25° 18'	23° 51'	22° 12'
35°	34° 36'	34° 4'	33° 21'	32° 24'	31° 13'	29° 50'	28° 12'	26° 20'
40°	39° 34'	39° 2'	38° 15'	37° 15'	36° 0'	34° 30'	32° 44'	30° 41'
45°	44° 34'	44° 1'	43° 13'	42° 11'	40° 54'	39° 19'	37° 27'	35° 16'
50°	49° 34'	49° 1'	48° 14'	47° 12'	45° 54'	44° 17'	42° 23'	40° 7'
55°	54° 35'	54° 4'	53° 19'	52° 18'	51° 3'	49° 29'	47° 35'	45° 17'
60°	59° 37'	59° 8'	58° 26'	57° 30'	56° 19'	54° 49'	53° 0'	50° 46'
65°	64° 40'	64° 14'	63° 36'	62° 46'	61° 42'	60° 21'	58° 40'	56° 36'
70°	69° 43'	69° 21'	68° 49'	68° 7'	67° 12'	66° 8'	64° 35'	62° 46'
75°	74° 47'	74° 30'	74° 5'	73° 32'	72° 48'	71° 53'	70° 43'	69° 14'
80°	79° 51'	79° 39'	79° 22'	78° 59'	78° 29'	77° 51'	77° 2'	76° 0'
85°	84° 56'	84° 50'	84° 41'	84° 29'	84° 14'	83° 54'	83° 29'	82° 57'
89°	88° 59'	88° 58'	88° 56'	88° 54'	88° 51'	88° 47'	88° 42'	88° 35'

Angle of full dip	Angle between strike and direction of section								
	40°	35°	30°	25°	20°	15°	10°	5°	1°
10°	6° 28'	5° 46'	5° 2'	4° 15'	3° 27'	2° 37'	1° 45'	0° 53'	0° 10'
15°	9° 46'	8° 44'	7° 38'	6° 28'	5° 14'	3° 33'	2° 40'	1° 20'	0° 16'
20°	13° 10'	11° 48'	10° 19'	8° 45'	7° 6'	5° 23'	3° 37'	1° 49'	0° 22'
25°	16° 41'	14° 58'	13° 7'	11° 9'	9° 3'	6° 53'	4° 37'	2° 20'	0° 28'
30°	20° 21'	18° 19'	16° 6'	13° 43'	11° 10'	8° 30'	5° 44'	2° 53'	0° 35'
35°	24° 14'	21° 53'	19° 18'	16° 29'	13° 28'	10° 16'	6° 56'	3° 30'	0° 42'
40°	28° 20'	25° 42'	22° 45'	19° 31'	16° 0'	12° 15'	8° 17'	4° 11'	0° 50'
45°	32° 44'	29° 50'	26° 33'	22° 55'	18° 53'	14° 30'	9° 51'	4° 59'	1° 0'
50°	37° 27'	34° 21'	30° 47'	26° 44'	22° 11'	17° 9'	11° 41'	5° 56'	1° 11'
55°	42° 33'	39° 20'	35° 32'	31° 7'	26° 2'	20° 17'	13° 55'	7° 6'	1° 26'
60°	48° 4'	44° 47'	40° 54'	36° 14'	30° 29'	24° 8'	16° 44'	8° 35'	1° 44'
65°	54° 2'	50° 53'	46° 59'	42° 11'	36° 15'	29° 2'	20° 25'	10° 35'	2° 9'
70°	60° 29'	57° 36'	53° 57'	49° 16'	43° 13'	35° 25'	25° 30'	13° 28'	2° 45'
75°	67° 22'	64° 58'	61° 49'	57° 37'	51° 55'	44° 1'	32° 57'	18° 1'	3° 44'
80°	74° 40'	72° 75'	70° 34'	67° 21'	62° 43'	55° 44'	44° 33'	26° 18'	5° 31'
85°	82° 15'	81° 20'	80° 5'	78° 19'	75° 39'	71° 20'	63° 15'	44° 54'	11° 17'
89°	88° 27'	88° 15'	88° 0'	87° 38'	87° 5'	86° 9'	84° 15'	78° 41'	44° 15'

*This table has been adapted from Appendix I, on p. 128 in Dr. A. R. Dwerryhouse's "Geological and Topographical Maps," published by Messrs. Edward Arnold, London. Adaptation is reprinted from F. H. Lahee's FIELD GEOLOGY published by McGraw-Hill Book Company.



"Better send an order out to Wards for some peridotite. The surface people are going to be terribly disappointed if they don't come up with some pretty soon."

New Journal on Southeastern Geology

Southeastern Geology is a new quarterly journal devoted to the geology of the Southeast.

The large volume of superior research now being conducted has led to the need for expanded facilities for publication. Furthermore, papers of a regional nature do not always warrant the distribution of a national or international journal.

Southeastern Geology offers a medium for publication of short papers without delay. A length of ten to fifteen pages is desirable. The subscription rate is $5.00 per calendar year; the first issue is now available.

Inquiries concerning subscriptions and manuscripts should be addressed to:

Southeastern Geology. Department of Geology, Duke University, Box 6665, College Station, Durham, North Carolina.

DIP, DEPTH, AND THICKNESS OF INCLINED STRATA

Dip	Thickness	Depth
1°	1.75	1.75
2°	3.49	3.49
3°	5.23	5.24
4°	6.98	6.99
5°	8.72	8.75
6°	10.45	10.51
7°	12.19	12.28
8°	13.92	14.05
9°	15.64	15.84
10°	17.36	17.63
11°	19.08	19.44
12°	20.79	21.26
13°	22.50	23.09
14°	24.19	24.93
15°	25.88	26.79
16°	27.56	28.67
17°	29.24	30.57
18°	30.90	32.49
19°	32.56	34.43
20°	34.20	36.40
21°	35.84	38.39
22°	37.46	40.40
23°	39.07	42.45
24°	40.67	44.52
25°	42.26	46.63
26°	43.84	48.77
27°	45.40	50.95
28°	46.95	53.17
29°	48.48	55.43
30°	50.00	57.74
31°	51.50	60.09
32°	52.99	62.49
33°	54.46	64.94
34°	55.92	67.45
35°	57.36	70.02
36°	58.78	72.65
37°	60.18	75.36
38°	61.57	78.13
39°	62.93	80.98
40°	64.28	83.91
41°	65.61	86.93
42°	66.91	90.04
43°	68.20	93.25
44°	69.47	96.57
45°	70.71	100.00

Dip	Thickness	Depth
46°	71.93	103.55
47°	73.14	107.24
48°	74.31	111.06
49°	75.47	115.04
50°	76.60	119.18
51°	77.71	123.49
52°	78.80	127.99
53°	79.86	132.70
54°	80.90	137.64
55°	81.92	142.81
56°	82.90	148.26
57°	83.87	153.99
58°	84.80	160.03
59°	85.72	166.43
60°	86.60	173.21
61°	87.46	180.40
62°	88.29	188.07
63°	89.10	196.26
64°	89.88	205.03
65°	90.63	214.45
66°	91.35	224.60
67°	92.05	235.59
68°	92.72	247.51
69°	93.36	260.51
70°	93.97	274.75
71°	94.55	290.42
72°	95.11	307.77
73°	95.63	327.09
74°	96.13	348.74
75°	96.59	373.21
76°	97.03	401.08
77°	97.44	433.15
78°	97.81	470.46
79°	98.16	514.46
80°	98.48	567.13
81°	98.77	631.38
82°	99.03	711.54
83°	99.25	814.43
84°	99.45	951.44
85°	99.62	1143.01
86°	99.76	1430.07
87°	99.86	1908.11
88°	99.94	2863.63
89°	99.98	5729.00

This table may be used for determining the thickness of inclined strata of the depth of a point in an inclined stratum provided the dip and the breadth of outcrop on a horizontal surface are known. Divide the breadth of outcrop by 100 and multiply the result by the constant for thickness (of depth) for the given dip.

This data sheet when cut out and punched will fit a handy pocket-size notebook available from almost any stationery store. There are many and varied data sheets available commercially in this size. If you have ideas for helpful data sheets write to Dr. R. M. Foose, Stanford Research Institute, Menlo Park, California. Chairman AGI Data Sheet Committee.

MORE ABOUT OUR COVER

Our cover for this issue, a photograph by Warren Hamilton and Philip T. Hayes of the U. S. Geological Survey, shows an isoclinical flow structure at the side of the lower Taylor Glacier, South Victoria Land, Antarctica.

This valley glacier moves by sliding over its floor, by recrystallization along its pervasive foliation planes, and by shear along silty layers near the base. The speed of glacial flow increases upward. The near-base layers of dark ice-saturated silt are in many places rolled into structures resembling nappes, such as the one pictured. The upper limb of this isocline is turned over by differential forward flow at the fold axis, and the fold form progresses down-glacier at a speed intermediate between the speeds of the upper and lower limbs.

Ice displays many features of the fabric and structure of metamorphic rocks, and the methods of structural geology can be applied fruitfully.

GEOLOGY in the Public Eye

by Robert L. Bates

Robert L. Bates, Department of Geology
Ohio State University, Columbus, Ohio

Can the scientist really get through to the layman? This subject was tackled by M. W. Thistle, chief of public relations for the NRC of Canada, in *Science* for April 25, 1958. He argues that only a tiny bit of scientific knowledge can ever be transmitted to the general public. If the value 100% is given to what scientists know, then the barriers of language and scientific sophistication reduce what it is possible to tell to 1%; the barrier of military and economic security leaves 0.25%; competition with other news for printed space cuts the figure to 0.02%; and the scanty attention paid to the story by the ultimate reader leaves half of this, or 0.01%, of what scientists know that ever gets through to the mind of the layman. This sounds discouraging, but Thistle argues that the 0.01% can be made interesting and valuable if the scientist (1) assumes *no technical knowledge* on the part of his audience, (2) *omits all details*, writing only about general concepts, and (3) uses analogy and simile in *everyday terms*. Assignment: prepare a geological highway marker; a talk for a general audience on the most recent advances in your own specialty. . . . The nature and origin of petroleum is spectacularly loused up in the May issue of *True*, in an article about T. W. Murray, the wildcatter . . . Four more Swiss stamps have appeared that picture minerals and fossils . . . The committee on oceanography of the NAS-NRC states that from the military viewpoint the problems of the ocean are infinitely more urgent and important than those of outer space. Yet the public eye is still inclined upward . . . What may help to return it to earth is, so help us, that project to drill a hole to the earth's mantle (the "Mohole") in 15,000 feet of water. The NSF-NAS-NRC has got a committee at work, "to place the project on a firm scientific basis." They say that if we don't drill the hole the Russians will. Well, as the man says, Why not? As it stands, we are racing to see if we can't pour our money down a hole in the sea floor faster than the Russians can. This isn't scientific and it doesn't make good sense. The whole project started as a joke and it should be allowed to die as one.

RMAG FIELD TRIP

Oct. 7-10

The RMAG Field Trip and Symposium, October 7-10, 1959, will concentrate on the Cretaceous sedimentary section in Colorado and adjacent areas of Wyoming. The trip will begin at Saratoga, Wyoming, and end at McClure Pass, between Grand Mesa and White River National Forests, near Carbondale, Colorado. Emphasis will be placed on field examples in the Piceance and Sand Wash Basins and the tie-in with the Washakie Basin of south-central Wyoming. Interested persons should write ROBERT L. KRETZ, *(Alpine Oil Co.) 2425 Brentwood, Lakewood, Colorado.*

Geology for Kansas Science Teachers

Over one hundred high school science teachers from the schools of east-central Kansas journeyed together June 6 on an 8-stop, 1-day geology conference in the Flint Hills area. The minerals, fossils and other geologic features of the area were interpreted for the teachers by Kansas State Geologist, Frank C. Foley, aided by his staff members, J. M. Jewett and Stanton Ball, who led the field trip under joint sponsorship of the Kansas Geological Survey and Kansas State Teachers College at Emporia. This was the Third Annual Science Teachers Institute.

Lubbock Host to Southwestern Federation

Lubbock, Texas, will be the site of the second annual regional meeting of the Southwestern Federation of Geological Societies October 8-10.

Program Chairman John Brand, of Texas Tech, has announced a diversified technical program for the 1,000 geologists who are expected to attend. Among the many thought-provoking titles announced is a paper by John Thornton on *"Well Spacing, A Study in Economics"* and another by Sam P. Ellison entitled *"Why Not Make Paleontology Understandable?"*

The Southwestern Federation includes 4,000 members of nine local societies. General Chairman for the meeting is F. ALTON WADE, *Department of Geology, Texas Tech College, Lubbock, Texas.*

MANPOWER *in a column —*

By HOWARD A. MEYERHOFF
Scientific Manpower Commission
1507 M Street, N.W., Washington 5, D. C.

In June 1958 bachelors degrees were awarded to 2,891 majors in the earth sciences—all but 100 of them in geology. The small number of first degrees in geophysics, oceanography, and "all other" earth sciences suggests that these specialties lack undergraduate segregation and more properly belong in the graduate school.

At the graduate level 700 masters and 136 doctors degrees were awarded. That it is still fundamentally a man's field is statistically evident. Women received only 104 (3.6 percent) of the bachelors degrees, 21 (3 percent) of the masters, and 3 (2.2 percent) of the doctors.

In the engineering fields earned degrees were up last year in earth science fields. In geological engineering, 225 bachelors, 12 masters, 2 doctors; in geophysical engineering, 27 bachelors, 6 masters, 1 doctor; in mining engineering, 240 bachelors, 20 masters, 2 doctors; in metallurgical engineering, including both extractive and physical, 670 bachelors, 177 masters, and 63 doctors; in petroleum engineering, 687 bachelors, 74 masters, and 4 doctors.

Indications are that the figures for June 1959 will not be substantially different. For 1960 a marked drop is to be anticipated, and the downswing will continue, at least through 1962.

Belated as the action is, the appointment of an AIME committee to interest high school students in mining geology, mining engineering, and metallurgy may paradoxically prove to be a timely step.

Recruitment of young people must, however, have a solid economic base if it is to be successful. Right now the earth is the only solid base on which the earth sciences rest. There is no national mineral policy. With praiseworthy exceptions, neither oil nor mining companies have any discernible policy that assures a reasonable degree of job security for professional personnel. Nor do all our colleges have rigorous training standards for geologists.

Until there are dependable national policies to guide industry, dependable jobs to attract prospective recruits, and dependable competence in those recruited, the profession faces an uphill job in its attempts to interest young people. High school students in search of careers have the knack of asking searching questions, for some of which we lack acceptable answers. Perhaps we should seek out the answers before we look for recruits.

Fellowship Applications

Due by October 5

Applications will be accepted through October 5, 1959, for fellowships under the Senior Postdoctoral and Science Faculty Fellowship programs of the National Science Foundation.

Postdoctoral scientists who are citizens of the U.S. with special aptitude for further advancement through academic training will be considered for these awards on the merits of ability and scientific attainment. Candidates must have held the doctoral degree for 5 years or have equivalent education and experience. Seventy-five postdoctoral Fellows will be chosen.

Science Faculty Fellowships open to college teachers of science with at least 3 years of experience will be awarded to approximately 300 Fellows who have shown special aptitude and abilities in the teaching of science.

Annual stipends under these fellowship programs will be adjusted to match the salaried income of the recipients as nearly as possible with a maximum of $12,000. Fellows may engage in study or research at home or abroad. Application details may be received by writing *Fellowship Section, Division of Scientific Personnel and Education, National Science Foundation, Washington 25, D.C.*

You saw it in GeoTimes . . .

AUTOMATIC PURCHASE PLAN has been announced for the GEOLOGIC MAP OF CALIFORNIA, scale 1:250,000 (about 1 inch equals 4 miles) which is being issued in 27 sheets plus a master legend. The plan will permit receiving all maps of the series as they become available. An invoice will be issued with each map ($1.50) as it is shipped. Interested persons should write *California Division of Mines, Ferry Building, San Francisco 11, California.*

Popular Geology in Print

by Mark W. Pangborn, Jr.

The publication of a geological autobiography is all too rare an event, and when a volume comes along that is as delightfully revealing as the late *Charles Newton Gould's* COVERED WAGON GEOLOGIST (U. of Oklahoma Press, 1959, $4), we have double cause to rejoice. In it the endearing and modest Gould traces his life from country boy beginnings, through a long struggle to get an education, to his successes as Oklahoma's first State Geologist, petroleum consultant, and National Park Service advisor. There must be many among our senior scientists who have had equally rewarding careers; we hope that, after reading Gould's story, some of them will realize that their lives, too, are part of a priceless heritage, and will put them down on paper.

Geologist *Victor Oppenheim* records, in layman's language, the highlights of many years of prospecting for minerals and oil in the wilds of Peru, Bolivia, and Argentina in his interesting EXPLORATIONS EAST OF THE HIGH ANDES (Pageant Press, 1959, $5). JOURNEY THROUGH THE ROCKY MOUNTAINS AND THE HUMBOLDT MOUNTAINS TO THE PACIFIC OCEAN (U. of Oklahoma Press, 1959, $3.75), is the intriguing diary of *Jacob Heinrich Schiel,* the Heidelberg geology professor who accompanied Gunnison on his ill-fated 1854 expedition across southern Colorado and Utah in search of a transcontinental railroad route; the translation, the third in as many years, was made by Thomas N. Bonner.

Aimed at teen-agers but quite suitable for the uninitiated adult is *Margaret Mason Shaw's* CANADIAN PORTRAITS: TYRRELL, CAMSELL, CROSS, LA BINE: GEOLOGISTS AND PROSPECTORS (Toronto, Clarke Irwin & Co., 1958, $2.50), in which are sketched the lives of two great field geologists and of the two scientific prospectors who discovered Steep Rock iron and Great Bear Lake pitchblende. Fine for the high school student or adult with scientific interests is VENTURE TO THE ARCTIC (Penguin Books, 1958, $.95); edited by *R. A. Hamilton,* this account of the British North Greenland Expedition of 1952-54 shows topographers, geophysicists, and geologists at their work, and stresses scientific accomplishments.

You saw it in GeoTimes . . .

WATER NEWSLETTER is a new publication on water problems, programs, etc., published twice monthly by the *Water Information Center, Inc., 60 E. 42nd St., New York 17, N. Y.*

A biography that will stick in your memory is *David Lowenthal's* brilliant GEORGE PERKINS MARSH, VERSATILE VERMONTER (Columbia U. Press, 1958, $6.50); Marsh, philologist, lawyer, congressman, and Smithsonian Regent, is justly famed as the author of the pioneering work on conservation, MAN AND NATURE (1864).

Latest in the growing shelf of popular geophysics books is *Arthur Beiser's* OUR EARTH (Dutton, 1959, $2.95), a brief history of geophysical discovery, which shows how some of the great scientists, from Archimedes to Urey, worked out their conclusions as to the earth's shape, mass, movement, magnetism, internal structure, and origin; fine for ages 14 up.

Time Magazine's Education section, in commenting some months ago about promising new chemistry films that are in preparation, referred to "the clichés of classroom science films . . . an oil well gushing, the tide of coronation music . . . familiar to every schoolboy who has slumped, bored but gratefully relaxed, through a reel or two of respite from the chore of learning."

As sometimes happens in news-magazines, a touch of sardonic exaggeration may here emphasize a point; but teachers who have viewed many films can recognize a distressing degree of truth in the words.

Why?

Perhaps many of us are partly to blame. Have we as teachers and scientists made known our views to those who are planning and producing films? Have we, when asked to comment on a picture we have used, or to make suggestions for pictures that are planned, either ignored the request, or hurriedly scribbled something brief and bland, in order quickly to return to our research on Tertiary volcanism and its effect on trilobite metabolism?

With sputniks soaring and school enrollments rising, should we not now give more attention to planning and producing the best possible visual aids for teaching? In the race for excellence, whether of individuals or nations, there is no substitute for quality minds, and outstanding rigorously challenging visual aids can help achieve this goal in minimum time.

FILMS OF INTEREST

BEACH AND SEA ANIMALS. 16 mm. Sound. Color or black and white. 11 minutes. 1957. *Reviewed by Joe S. Creager.* Examines the ecologic relationships of invertebrates such as the starfish, sea urchin, octopus and crab, living in or near a beach environment. Very well produced, with many close-ups. Suitable for either high school or college level classes. DISTRIBUTOR: *Encyclopaedia Brittannica Films, Inc., 1150 Wilmette Ave., Wilmette, Illinois.* Purchase: Color $120; black and white $60. Loan: Color $4.00; black and white $2.50.

NATURE OF GLASS. 16 mm. Sound. Color. 37 minutes, 1958. This film reviews the structure, properties and uses of various kinds of glass. DISTRIBUTOR: *Association Films, Inc., Broad at Elm, Ridgefield, New Jersey.*

THE ADMIRABLE DISCOURSES OF BERNARD PALISSY, *translated by Aurele La Rocque, 264 pp., 1957, University of Illinois Press, Urbana, Ill. $5.50.*

This translation has been available for several years, but has not been previously reviewed in GeoTimes.

Geology is steeped in the tradition of penetrating observations and reasoning. For the geologist whose pace is too fast to provide for contemplation, this translation of Palissy's *Discours Admirables* (1580) will provide an impetus for reflection on the development of geologic thinking. Some may be surprised to find observations compatible with current concepts set forth by Palissy.

THE NESSON ANTICLINE OF NORTH DAKOTA, *North Dakota Geological Society, 1959, Manual of geologic and reservoir data, $15.00; Map, 1" = 4000 ft. $10.00. Order from Frances S. Bleth, P. O. Box 961, Bismarck, N. D.*

More details about the above report and map and other reports of the North Dakota Geological Society may be had by writing the above mentioned address.

PHYSIOCHEMICAL BASIS OF THE ANALYSIS OF THE PARAGENESIS OF MINERALS, *translated from the Russian book of D. S. Korzhinskii (1957) under auspices of the Geochemical Society, 142 pp., 1959. Consultants Bureau, Inc., 227 West 17th St., N. Y. 11, N. Y. $7.50.*

Rated by many as an outstanding contribution to the literature on geochemistry. This book was translated under supervision of the Geochemical Society and subsequently edited by the Russian author.

GUIDEBOOK: EOCENE-MIOCENE OIL-URANIUM FIELD TRIP: *in the Falls City, Tordilla Hills and Fashing Areas, Texas, by Eargle Pinkley and de Vergie, (Leaders), 67 pp. and map, Dec. 1958, Southwestern Geological Society, San Antonio, $5.50.*

MANUAL OF MICROPALEONTOLOGICAL TECHNIQUES *edited by James D. McLean, Jr., McLean Paleontological Laboratory, Box 916, Alexandria, Virginia, 1959. 152 pp. (loose leaf). $15.65.*

Original and reprinted articles on techniques, in loose-leaf format for insertion of supplements as published by the laboratory. A source reference for Micropaleontological laboratories and research laboratories wanting access to methods of staining, photomicrography, sectioning, etc. Edition limited to 150 copies. Supplements to be issued at irregular intervals. A second edition will be published if the demand indicates a need for it.

WORK BOOK FOR INVERTEBRATE PALEONTOLOGY, *2 Vols., by James F. L. Connell, 1958, Wm. C. Brown, Inc., 135 Locust St., Dubuque, Iowa., Vol. 1, 92 pp., $1.75 and Vol. 2, 106 pp., $2.00.*

A work book prepared for use in a two semester course in invertebrate paleontology. It is designed to simplify the teaching of a difficult subject and to clarify some of the vague, mysterious aspects of the subject. It should aid in stimulating student interest.

TOPOGRAPHIC MAPPING IN AREA OUTSIDE THE CONTINENTAL UNITED STATES, *1959 status index map available free on request from Map Information Office, U.S. Geological Survey, Washington 25, D. C.*

Includes Alaska, Hawaii, and U. S. possessions.

TOPOGRAPHIC MAPPING IN THE UNITED STATES, *1959 status index map available free on request from Map Information Office, U. S. Geological Survey, Washington 25, D. C.*

THE GEOCHEMISTRY OF RARE AND DISPERSED CHEMICAL ELEMENTS IN SOILS, *2nd Edition, revised and enlarged, translated from the Russian book of A. P. Vinogradov under the auspices of the Geochemical Society, 209 pp., 1959, Consultants Bureau, Inc., 277 West 17th St., New York 11, N.Y. $7.50.*

This book presents important data on the geochemical distribution of chemical elements in soils and rocks.

THE FRIO FORMATION OF THE UPPER GULF COAST OF TEXAS, *by Houston Geological Society Study Group Report, L. B. Forney, Chairman, 5 pp., 1 chart, 1 section, 3 maps, 1959. Houston Geological Society, 234 Esperson Bldg., Houston, Texas, $3.25.*

WATER WITCHING U.S.A., *by Evan Z. Vogt and Ray Hyman, 248 pp., 1959, University of Chicago Press, Chicago 37, Ill., $4.95.*

This book is dedicated to the county agricultural extension agents of the United States from whom much of the data concerning water witchers was collected. Written for the non-scientific public the book should be required reading for all agricultural agents who provide advisory services to farmers. It also deserves the attention of suburbanites and some segments of industry where a significant capital investment in real estate is often jeopardized by faith in the whims of a peach tree branch.

The book, written by professional psychologists, has a rather humorous approach but at the same time effectively raises new doubts about the basis and validity of divining. Chapter 5, for example, is entitled *From Talking Horses to Talking Twigs.* In it the authors say "When we understand why the horse talks and why the Ouija Board spells, we will understand why the divining rod moves."

The geologist who reads this book will have some new ammunition to use in refuting the arguments of the superstitious, uneducated persons and the supposedly well-educated people who insist that the twitch of the wrist which sends the twig downward is a god-given power.

Appendix II of the book is a section by H. E. Thomas, U.S.G.S. Geologist, "Water-Well Location by Scientific Divination."

GEOLOGY OF THE OUACHITA MOUNTAINS—*A Symposium of 17 papers by 24 authors under auspices of the Dallas Geological Society and the Ardmore Geological Society for the Field Trip Committee of the 1959 AAPG-SEPM Meeting, 208 pp., with guidebook and 17 maps and cross sections, 1959. Dallas Geological Society, Box 253 SMU Station, Dallas 22, Texas. $10.50*

RADIOCARBON SUPPLEMENT TO THE AMERICAN JOURNAL OF SCIENCE, *edited by R. F. Flint and E. S. Deevey, Jr., Vol. 1, No. 1, 1959, 218 pp., Yale University, $2.50 (subsequent annual subscription rate $4.50).*

Presents in one volume the radiocarbon dating data which has been collected in various laboratories the world over. It also includes *A Bibliography of Radiocarbon Dating* by Frederick Johnson. This supplement will be issued annually in May.

DEAR EDITOR:

Your editorial comment on DEPLETION ALLOWANCES in the May-June issue was most timely. Of course, other minerals and ores should enjoy similar consideration to that given petroleum although existing allowances need to be maintained as a minimum condition. And, there are efforts being made now to reduce or modify such allowances in a number of instances, or alter the methods of application in regard to ores and minerals other than petroleum.

However, any depletion allowance rate or method can be defeated by simply reducing the restrictions on imports. Some aspects of this in regard to petroleum have been pointed out by Mr. Graham R. Curtis in his letter also published in the May-June issue. Again, similar conditions apply to other minerals and ores and products derived from them such as metals, for example.

The benefits of favorable depletion allowances can be voided too by other especially rigged revenue acts such as represented by subsection (c) of section 615 of the Internal Revenue Code of 1954. Perhaps this particular section of our revenue code is directly responsible for many mining engineers and geologists being unemployed today.

Now, an effort is being made to correct this latter situation by means of A BILL TO AMEND THE INTERNAL REVENUE CODE OF 1954 SO AS TO REMOVE THE FOUR-YEAR LIMITATION ON DEDUCTION OF EXPLORATION EXPENDITURES, H. R. 4251, by Representative Howard H. Baker, of Tennessee, in the current session of Congress.

This, then, offers all those interested in applications of the earth sciences an excellent opportunity to get their teeth in to something specific. In total, here is a whole program which needs the active and aggressive support of every interested person. It is urgent for each one to lend his best hand now.

Sincerely yours,

HUBERT O. DE BECK
Johnson City, Tenn.

DEAR EDITOR:

I have just read with great interest and enthusiasm the article entitled *"Revival of Geology in Pennsylvania High Schools"* by Dr. John H. Moss which appeared in the May-June issue of *GeoTimes*. I would appreciate it very much if you would advise me what other states, if any, are, or plan to teach geology in their high schools to the extent described by Dr. Moss.

Very truly yours,

CARLOS L. SMITH

DEAR EDITOR:

I particularly enjoyed this issue. Old age is probably back of it, so the attached check.

I was one of the first geologists employed by M. J. Munn and mapped the south end of the Cushing anticline during the cold winter of 1913-14. Did it with a planetable and a goodly part while there was snow on the ground.

Please give Dr. Dickey my thanks for his kind handling of M. J. He was a gentleman's gentleman of the Old School.

Sincerely,

FRANK BRYAN

DEAR EDITOR:

In reply to Dr. Longwell's, I presume, rather hastily composed letter; may I enter a plea that Hapgood's manuscript be exhumed from the circular file at least temporarily?

Granting that the 'Shifting Crust' idea has some "glaring weaknesses," so too do all currently taught theories of earth origin and subsequent deformation. Science would like to advance from hypothesis, to theory, to law but rarely has the good fortune to realize this ambition. The more commonly observed process of advance is from hypothesis 1, to hypothesis 2, to hypothesis 3 . . . etc., each in its turn providing some slight insight into the nature of that nebulous quantity fact.

So let us dust off our copies of 'Earth's Shifting Crust' and place it on the work bench where it belongs. Study it, criticize it, and attempt to offer a better answer. "Out the window" with discarding imperfect ideas. After all, without our imperfect ideas we would have no thoughts at all.

Respectfully,

F. N. EARLL,
Department of Geology
Montana School of Mines

the top of the T rod and the rod is inclined until the upper limb is horizontal [and at right angles to the strike], the lower limb will be in the plane of bedding projected upward toward the observer. By sighting down this limb the bed in whose plane it lies is determined and the beds between this plane and the foot of the rod have a thickness equal to its length. The foot of the rod is now moved up to this bed and again brought into position so that the upper limb of the clinometer is horizontal and the rod is at right angles to the bedding, and a new point is obtained by sighting down the lower limb. Count is kept of the unit thicknesses and the total thickness between determined limits is obtained with no calculation except a multiplication of the length of the rod into the number of sights taken. The method is very similar to the use of the hand level for obtaining elevations, and becomes identical with it when the dip becomes zero.

"When the Abney level or the Brunton compass is used the method is the same, except that the vernier arm carrying the level is set at a point on the divided circle corresponding to the dip angle."

Measurements are most readily made at right angles to the strike, but need not be, despite statements or implications to the contrary by previous writers. Measurement oblique to strike may be done simply by setting the clinometer at the apparent (lower) dip in the measurement direction, which is determinable from standard apparent-dip nomograms or tables, if not directly from exposures.

Discussion of Method

Jacobstaffing is fast and easy in nearly all field settings. It is most readily used in rough country where the strata dip 5° to 50°, where the sights in the dip direction are short, and where measurement normal to strike is feasible. The equipment needed is simple, inexpensive, and readily obtained. No assistant is needed, and no trigonometric calculations are involved.

Of course, none of these advantages means much if the method is insufficiently accurate. The accuracy of a field operation of the sort involved here is most difficult to assess if accuracy is distinguished from precision and defined as the degree of correspondence between a real quantity and the measurement of it. On this basis, it can only be said that measurements with the Jacob staff can be highly precise, or reproducible. For example, assorted observers making repeated field tests with staff-mounted Abney levels at dips ranging from 10° to 50° attained results varying by less than 3 feet per 100 feet of section measured. Such precision is attainable no doubt because errors, though inescapably numerous in such a crude system, are random and tend to cancel out. Careless techniques can, however, lead to systematic cumulative errors that significantly decrease precision.

It is true that reproducibility, or precision, of 3 percent is well below the potential precision of the telescopic alidade or the steel tape. But precision of a high order is of little use in measuring deformed, incompletely exposed rocks, for under such conditions true thickness cannot be closely approached anyway, however carefully the apparent thickness is measured, as allowance must be made for several percent of error, due to inaccuracies in measuring attitude and to undetected variations in attitude. Thus, any method that gives results reproducible to within a few percent is sufficient. As Aristotle noted some time ago, *"It is the mark of an educated man to look for precision in each class of things just so far as the nature of the subject admits . . ."* (Ethics, book 1, chapter 3, translation by W. D. Ross).

Jacobstaffing is by no means the answer to all problems of measuring thickness in inclined strata, as Hayes was well aware and as Bröggi pointed out in detail. Where many sights longer than 300 feet are needed, magnification of the sort provided by the telescopic alidade is likely to be needed also. The staff is usable but offers no advantage over the steel tape where the angle between backslopes and bedding is a right angle, or where dips are above 50°. By its design, the Abney topographic level is limited to dips of 60° or less. In rare circumstances (see Bröggi for full discussion), even where the dip is within the range of the Jacob staff, the relationship between dip and surface slope makes using the instrument awkward; for instance, on those rare backslopes, such as fault scarps, where the strata plunge into the hillside at an angle of more than 90° from the surface slope, the base of the staff must be placed in space on the projection of the dip to make a direct measurement. A further minor difficulty is that thicknesses within the 5-foot staff length must be interpolated, a procedure that is made easier by painting 1-foot marks on the rod. A shorter or collapsible staff to measure shorter intervals can, of course, be devised, but its use requires very durable knees or a very short operator.

In addition to mechanical limitations of the sort listed, the method does not offer overall internal checks of the thickness measured, and the resulting data are, in a sense, uncontrolled. The total thickness is the sum of a series of discrete measurements and any errors must be assumed to be evenly distributed. Therefore, no way exists to discover gross operator error, such as miscounting the number of 5-foot intervals. The greater the unit thickness being measured, the greater the chance of significant error. This weakness is, of course, shared with all other methods that employ a short arbitrary unit of measurement, such as the height of the operator or the length of a tape.

Status of Method

A review of American stratigraphic literature published in the decade 1949-1958, and discussion with scores of colleagues of the most varied training and experience, indicates that few geologists have been using the Jacob staff. In this period the Geological Society of America, the American Association of Petroleum Geologists, and the U.S. Geological Survey have among them published a total of 98 papers containing detailed measured sections, each involving at least 50 individual thickness measurements, in beds inclined 5° to 50°. In 64 of these contributions there is no mention made of a method of measurement; in the remaining 34, sections were measured by steel tape in 11, by telescopic alidade in 9, by pacing in 5, by scaling off topographic maps in 4, by hand level in 3, and by Jacob staff (with homemade clinometer) in only 2; curiously enough, the simple method of Hewett (1920) was reported in none, though widely mentioned in pertinent literature.

I have not checked other than American usage of Jacobstaffing but suspect that it is even less often employed elsewhere, as it is mentioned in but one of the handful of European handbooks for field geologists or geologic engineers in the Geological Survey Library at Denver, a British publication by Greenly and Williams (1930), and there ascribed to the Americans Walcott and Blackwelder.

Why hasn't Jacobstaffing become popular? Probably the main reason has simply been lack of knowledge. Only a few of the many colleagues I questioned had ever heard of the method, and still fewer had ever tried it. Hayes' handbook went out of print in the early '20's, and for many years guidance in field techniques came almost solely from Lahee's handbook (1916, 1952) which has no mention of direct measurement, although it describes several simple methods that involve trigonometric calculation. Contributory, I suspect, has been the notion that measurements involving calculations are somehow more "scientific" and thus more "accurate" than direct ones. Another contributing factor, possibly, has been an unrealistic attitude about attainable accuracy coupled with failure to appreciate the distinction between accuracy and precision. Finally, the absence of internal checks may have discouraged some potential users. This last is a valid objection but not, in my opinion, an overriding one. The method deserves wider use.

Instruments

It is easy to test the method for oneself. The simplest type of staff, employing a fixed open-sight pendulum clinometer such as described by Kummel, can be made in an hour or so with common materials. Operator error readily arises with this device because 1) the sight-line is open; and 2) it is difficult to observe simultaneously the clinometer and the line of sight. The modifications recently proposed by Ingebrigsten and Bergstrom largely overcome the second of these problems but are rather elaborate.

Quickly made, too, is a Jacob staff using the Brunton compass. Staffs and ball-and-socket yokes for attaching Brunton compasses with side slots (Ainsworth type) are available for a few dollars from standard instrument companies. This device has the weaknesses of the pendulum clinometer and invites additional operator error because it is hard to keep the vertical axis of the yoke and compass parallel to the staff; parallelism can be readily attained, however, by using a rigid mounting like that figured by Blackwelder (p. 491). Another disadvantage is that a second expensive Brunton is needed if much time is not to be lost shifting a single Brunton between measuring thickness and measuring attitude.

If much work with the Jacob staff is planned, it is worthwhile to use the Abney-level type (see fig. 1). It provides a fairly long, closed sight-line and is designed for simultaneous viewing of sight-line and clinometer; also, it is sturdy and easily attached to a rod. The side-mounted arc of the Abney level (see fig. 1) should be graduated in degrees. Also available are arcs graduated in percentage of grade, in topographic arc, and in rise in feet per chain, but such types of arcs should, of course, be avoided for stratigraphic meas-

urements. Several makers offer essentially the same instrument at about $35.00.

My experience with various kinds of rods and brackets for joining rod and Abney may be helpful. The rod I use is made of ¾" hardwood doweling, which is stocked by most lumberyards in 5-foot or greater lengths. To protect the base the staff should be covered with some sort of tip; the surveyor's Jacob staff is traditionally ironshod, but I prefer rubber tips of the kind used for crutches and canes. The dowel should be trimmed so that the overall length from the base of the tip to the centerline in the Abney level is 5 feet; this length will be close to 4'11". Rings are painted at 1-foot intervals, with measurements beginning at the base of the protective tip. For easy carrying, the rod may be cut in two, and hinged or fitted with a sleeve. Some of my colleagues have had staffs made of segmented aluminum tubing.

A rude but serviceable bracket for attaching the Abney can be put together in a few minutes from common materials available in any hardware store. Required are: one 8-inch 6-hole mending plate; one 3" x 3/16" brass flathead bolt or screw; one corner brace; and two ¾" square thumb screw brackets or two wide thick rubber bands. The device is assembled as follows: (1) Square off one end of dowel; (2) tap this end with a 5/32" hole; (3) cut off about 2" at one end of the mending plate so that one hole is centered in the plate; (4) attach plate to dowel with brass bolt (preferred) or screw; (5) strengthen the joint with a corner brace; (6) attach the Abney level to the plate with brackets or rubber bands.

If shop facilities are available a more elegant and durable bracket can easily be made, at little more cost. The one sketched in figure 1 was designed with the help of Charles G. Bay, Chief of the Geological Survey's instrument shop at Denver and has been found to be the most practical of several tried in the field. The level fits tightly without screws, which are well avoided as they tend to come out during use and be lost. The large plate, on the side opposite the arc, is to protect the level so that the instrument may be laid down between observations.

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ROCK CHIPS

by SANDSTONE SAM

On trilobites, one expert offers the following opinion as to why some were preserved flat and others curled up: "The curled-up trilobites had more sound economic judgment and hence more able to make ends meet."

• • •

The student who recently wrote about "lapsi lausie" was referring to a mineral not the prof's memory.

• • •

"Most of the streams of Puerto Rico flow in three directions" (stolen from Geochemical News).

• • •

"The samples were given random numbers to insure complete lack of objectivity by the analyst" (cribbed from the same source).

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Location: Tulsa, Oklahoma. Forward resume and other particulars to Box 109.

TEACHING POSITION. Mineral exploration and applications of geology to mining operations. Master's degree. Commercial experience, 5-10 years. Dean Vernon E. Scheid, Mackay School of Mines, University of Nevada, Reno, Nevada.

MINING GEOLOGIST. Masters degree. Geologic field investigations and preparation of reports. Director, Vernon E. Scheid, Nevada Bureau of Mines, University of Nevada, Reno, Nevada.

MINERALOGIST-PROFESSOR wanted for two year assignment at University of Indonesia in Java. Specialist in field qualified to teach optical methods. Ph.D. degree preferable with teaching experience. Salary and rank open. Complete biographical data including a small photograph to Coordinator of ICA Programs, University of Kentucky, Lexington, Kentucky.

ASSOCIATE SCIENTIST (Geology) Salary $8652 to $10,362 in 5 annual increases. One vacancy in State Education Department in Albany, N. Y. Candidates must be legal residents of New York State; have completed 60 graduate semester hours with specialization in Geology; 4 years professional geology experience of which 2 years must have involved administrative responsibility and included work on significant research projects as evidenced by publication. Civil Service Examination on September 26, 1959. For detailed announcements and applications write to Recruitment Unit Box 90, New York State Civil Service Department, The State Campus, Albany 1, New York.

STATE UNIVERSITY OF NEW YORK, Teachers College at Plattsburg, New York. September 1959—Geologist, capable of handling work in Physical Geology, Historical Geology, Geomorphology, Meteorology and Astronomy. Apply to: F. Reese Nevin, Department of Science and Mathematics.

PROGRESSIVE MINING COMPANY seeks senior geophysicist to cooperate with geologists in coordinating geophysical program for mineral exploration group. Permanent position Western U. S. Qualifications: age 35-40; M.S. or equivalent; minimum 8 years work with mining companies. Salary commensurate with qualifications and experience. Box 110.

STATE UNIVERSITY TEACHERS COLLEGE, New Paltz, New York. September 1959. Undergraduate and graduate teaching in the area of general economic and historical geology, etc., as well as work in general education program of earth sciences. Man preferably under 40 with Ph.D. State qualifications, training, experience, interest, and reply to Dr. Robert W. Pyle, Acting Chairman, Division of Natural Science.

X-RAY DIFFRACTION AND FLUORESCENCE: Position in Analytical Research Group in applications of diffraction for identification of minerals and inorganic chemicals: fluorescence for elemental analysis of inorganics, minerals, and metals. Strong knowledge of mineralogy essential; DTA, microscopy, and analytical chemistry very useful. About half time in service to other groups in research department and half time in research and development toward applications of X-ray in company operations. Salary open depending upon qualifications and experience. Send resume to: Employment Office, Kaiser Aluminum & Chemical Corporation, Permanente, California.

POSITIONS WANTED

BOX 398. WHO NEEDS A 29 year old, married exploration geologist with varied mineral deposit experience who can write? Has written articles and reports for all levels of geological interest and knowledge. Open to any attractive offer.

BOX 481. RESEARCH PETROLEUM GEOLOGIST-STRATIGRAPHER, 30, M.S. Extensive experience in most provinces U. S. and Canada. Have utilized newer exploration tools; Entropy Lithofacies mapping, Gamma-Halo surveys, porosity maps, moment maps, etc. Desire position of responsibility in research or exploration. Executive ability.

BOX 552. GEOLOGIST, Ph.D., 34, married. Desires permanent teaching position in small to moderate size school and town, preferably in south or west. Broad geological background in teaching and research, especially in sedimentary rocks, principles of stratigraphy, petroleum geology, and mineralogy. Presently employed as geologist by major oil company.

Box 585. GEOLOGIST, experienced explorationist with diversified background in the Four Corners, Panhandle and Permian Basin. Previous work includes sub-surface, supervision and seismograph.

Box 594. PALEONTOLOGIST - GEOLOGIST, M.S., 27, married. Two years experience in micropaleontology and stratigraphy. Desires foreign position. Resume on request.

Box 601, GEOLOGIST, with business training, 33, single, M.S., 1 year geology instructor, 6 years experience. 1 year business school at university, some sales experience. Veteran. Interested in diversified firm, domestic and/or foreign.

Box 603. MINING GEOLOGIST-EXPLORATION ENGINEER; Ph.D. level education and registered professional engineer seeks more challenging and responsible position in industrial or consulting organization where creative thinking, initiative, competence, and resourcefulness are appreciated. Diversified experience in field and mining geology, exploration, and property evaluation, plus related supervision, administration, and mining law background. Veteran, late 30's, family. Employed; available 1 to 2 months.

BOX 607. GEOLOGIST, B.A., 30, family, 3 years engineering geology experience; structural geology, ground water, materials investigations, reports. Also 2 years surveying experience. Desires position in mining, exploration, or engineering geology.

BOX 608. Ph.D., retiring after 20 years tropical service with major company, desires moderate teaching load: geography, photo interpretation, physical, structural, stratigraphic, economic

POSITIONS WANTED—*Continued*

geology. Protestant churchman. Wife competent librarian. Academic environment and privileges would outweigh high salary. Southwest preferred.

BOX 609. GEOLOGIST, 27, married, B.S. in June 1959. General geology background. Desires domestic or foreign position. Resume on request.

BOX 610. PALYNOLOGIST, MS, 34, married, five years experience in Spore and Pollen field. Desires to relocate with company with such a program or interested in such. Would consider university undergraduate teaching with possibility of research and advanced degree in Palynology.

BOX 611. ASSISTANT PROFESSOR, Ph.D. major university wishes to teach in college or university in more desirable area. 3 yrs. teaching and 6 yrs. varied industrial experience. Primarily interested marine geology, paleontology, sedimentation, mineralogy. Active researcher, member prof. societies. Resume on request.

BOX 612. MUSICIAN and composer; full professor; major university; Yale graduate; 13 yrs. teaching experience; former violinist in internationally famous string quartet; Guggenheim Fellow; married; 2 children; wishes to teach in college or university in more desirable area; amateur geologist; would appreciate your bringing this ad to the attention of your Music Department. Resume on request.

BOX 613. PHOTOGEOLOGIST, B.A., 33, family. Some graduate work. 4 years exploration experience in Alberta Basin and Colorado Plateau and research in fracture studies. Some field and well sample work. Desire a position in petroleum exploration and/or research. References upon request.

BOX 614. RETIRED PROFESSOR of Geology desires a one year connection with a school in the south or southwest. Married, 68 years of age, active, excellent health. Is prepared to teach physical geology, optical mineralogy, petrography of igneous, metamorphic, sedimentary rocks, and engineering geology. Would teach historical geology or mineralogy.

BOX 615. GEOLOGIST, 31, Ph.D. by June 1959. Desire teaching position in college or university preferably in northern, midwest or New England states. Principal fields: petrology, geochemistry, mineralogy, structural geology. Some teaching and considerable field experience, as well as training in spectrography. Available Sept. 1959.

BOX 616. MINERALOGIST, M.S., all course work on Ph.D. completed, seven years field and teaching experience, desires teaching position in mineralogy and economic geology. Familiar with X-ray techniques and aerial photograph interpretation.

BOX 617. COLLEGE GEOLOGY TEACHER familiar with teaching many undergraduate and graduate geology courses desires new position beginning next fall.

BOX 618. PROFESSOR desires summer research or general geological field work. Particularly interested in stratigraphic studies and mapping.

BOX 619. GEOLOGIST, Ph.D., 29, Canadian, married, desires position in petroleum industry, Canada or foreign. Primary interests sedimentology and stratigraphy. Varied experience with government surveys and major companies. Available Sept. 1959.

BOX 620. GEOLOGIST, B.S., May I help you? Experienced as seismic crew observer and computer, foundation test boring and mineral investigations. Sales engineer and organizer. Presently employed as geologist. Desire progressive company.

BOX 621. HAVE EXPERIENCE, initiative and will travel. Stratigrapher, paleontologist (both micro and macro), petroleum geologist. Also have experience in surface geology, reservoir geology, some teaching, and familiar with principles of palynology. M.S. degree, 33 years of age, family. Eight years of professional work, both domestic and foreign, speak English and Spanish. Would like opportunity to teach, especially in small college, but will consider anything domestic or foreign.

BOX 622. ENGINEERING GEOLOGIST, M.S., 3 yrs. Ph.D. work, 55, married, 30 years experience, employed at salary equivalent to GS 15, desires position private corporation with foreign assignments in engineering geology.

BOX 623. PETROLOGIST, B.A., 1943, Ph.D. 1952, desires teaching position in liberal arts college with high academic standards and with enrollment about 1500-3500 or more; prefer southern New England, Middle Atlantic-Great Lakes, or Pacific Coast.

BOX 624. PETROLEUM GEOLOGIST. 8½ years Gulf Coast, 1 year Rocky Mtn.; M.S., trained in administration, developing exploration programs, developed and submitting prospects; desires position with company entering expioration, or expanding; prefer Houston, consider any area.

GEOCHEMIST, 43, Ph.D. (London), Head of Dept., is due for sabbatical leave any time from Jan. 1960 onwards, requires post of visiting professor or fundamental research in petroleum or mining industry in N. America or England. Several major publications and further works projected, aiming of opening up new orientations, such as, metamorphism of carbonaceous phase, certain geochemical aspects of hydrothermal, fumarolic and evaporite deposits, conversion mechanism of allotropic modifications; co-author of "Organic Geochemistry" to be published by Pergamon Press. Experienced lecturer, particularly in geochemistry and economic geology. Contact Prof. Dr. G. Mueller, Depto. de Geologia, Cas. 53-C, Universidad, Concepcion, Chile.

BOX 625. GEOLOGY INSTRUCTOR-M.A. Geology—2 years paleo-stratigraphy major oil co. Calif. teaching credential. 33—married—junior college preferred.

GEOLOGIST, M.S., 31, family. Varied experience. 3½ yrs. surface and 3½ yrs. subsurface with major oil companies in the Rocky Mountains. Primary interest is in regional studies or research. Desire to work for a petroleum company interested in using this approach for oil exploration. Available for work in Rocky Mountains or on West Coast. Rodney K. Williams, 2565 South Meade, Denver 19, Colorado.

BOX 626. PETROLOGIST-MINERALOGIST, 43, Ph.D., Japanese. 8 yrs. experience of field in N-China, SE-Asia and Japan. 11 yrs. experience of Asst. Professor in a Japanese University. Desire permanent position in school, laboratory, mine or association in any state of U.S.A. Salary open.

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